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(54) **Single-button actuated self-correcting automatic convertible top**

Eintastig betätigtes, selbstkorrigierendes automatisches Faltdach

Actionnement par touche unique pour un toit pliant à correction automatique

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- **PATENT ABSTRACTS OF JAPAN vol. 12, no. 374 (M-749)(3221) 6 October 1988 & JP-A-63 125 435 (JOHANN SEISAKUSHO CO.) 28 May 1988**

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Description

1. Scope of the Invention

[0001] This invention relates generally to automobile convertible tops, and more particularly to an automobile convertible top that can be opened and closed automatically.

2. Description of the Related Art

[0002] In the field of automobile design, convertible tops have been employed to provide the consumer with versatile styling. Most people are familiar with manual convertible tops, which are latched and lowered by hand. However, over the years many different types of automatic and semi-automatic convertible tops have been developed. Generally these convertible tops utilize one or more motors to move the various linkages and other movable elements from an extended (or top closed) position to a retracted (top open) position. Through the aid of motorized movement the user can raise and lower the convertible top more easily.

[0003] However, simply providing for motorized movement of the convertible top is not enough. For example, as described in US-A-2770489, on which the precharacterising portions of appended claims 1 and 8 are based, there are known motorized convertible tops that provide for limit sensors on the elements to determine whether the elements are in the "full retracted" or "full extended" position. However, such systems provide no information as to whether the linkage elements are simply near, rather than being at, one of the two fully articulated positions or not. As a result, these known systems, while being capable of causing the convertible top to be opened and closed automatically, require each sensed element to reach an extreme position before commencing the movement of the next element in the sequence necessary to accomplish the desired movement of the convertible top. Thus, it would be advantageous if a motorized convertible top system could allow simultaneous movement of various elements so as to accomplish the opening and closing of the convertible top using a series of movements that are more fluid and continuous and that both reduce the time necessary to accomplish the movements as well as improving the aesthetic appearance of the movements.

[0004] Another disadvantage of known motorized convertible tops is the fact that the elements may bind as the movements are sequenced, increasing the load on the motors and risking damage to the motors or elements as the motors try to "force" the elements to move. Especially when trying to accomplish simultaneous movement of multiple elements, the fact that one element may be slightly inhibited in its movement means that the other moving elements will reach their desired position sooner than will the binding element. Allowed to continue uncorrected, this misalignment of elements can result in the convertible top being cocked in an undesirable position and may cause damage to the convertible top mechanism. Therefore, it would be desirable if were here some way to monitor the movement of critical elements while they are moving simultaneously so that remedial action can be taken in the event that a misalignment situation arises. The remedial action could include stopping the movement of other elements while the binding element is still moved, allowing the slower, binding element to "catch up" with the other elements. The remedial action could also include reversing the movement of some elements in order to realign the convertible top and, once realignment is achieved, resuming normal movement of the elements. The remedial action could also include detecting an unrecoverable misalignment and shutting down the motors before the motors are overburdened.

SUMMARY OF THE INVENTION

[0005] It is therefore an object of the present invention to provide a system and method for lowering and raising an automobile convertible top where motive means, such as electric motors, move the various structural elements of the convertible top.

[0006] According to a first aspect of the present invention there is provided a system for lowering and raising an automotive convertible top comprising at least two relatively pivotable structural elements forming a support structure over which the top is mounted, said system comprising:

motive means associated with said convertible top for pivoting a first one of said structural elements about a first pivot point and for pivoting a second one of said elements about a second pivot point to move said convertible top to open and close the convertible top,
position sensing means associated with said convertible top; and
control means associated with said position sensing means and said motive means;

characterised in that
said position sensing means includes a first rotary variable resistance device mounted at said first pivot point and a second rotary variable resistance device mounted at said second pivot point, said first rotary variable resistance device being arranged to position sense throughout the range of motion of said first structural element about said first pivot point and to output instantaneous information on the angular position of the first element and said second rotary variable resistance device being arranged to position sense throughout the range of motion of said second structural element about said second pivot point and to output instantaneous information on the angular position of the second element; and

said control means is arranged to receive the angular position information outputted by both said first and second rotary variable resistance devices, to determine therefrom the instantaneous position of said convertible top and to actuate said motive means in response thereto.

[0007] According to a second aspect of the present invention there is provided a system for lowering and raising an automotive convertible top, said system comprising:

motive means associated with said convertible top for moving said convertible top to open and close the convertible top and for moving a tonneau cover pivotally attached to the automobile and beneath which the convertible top is arranged to be stored when retracted to its fully open position;
position sensing means associated with said convertible top and with said tonneau cover; and
control means associated with said position sensing means and said motive means;

characterised in that

said position sensing means includes a first position sensor and a second position sensor, said first position sensor being arranged to position sense throughout the range of motion of a structural element over which the top is mounted and to output instantaneous information on the angular position of that element and said second position sensor being arranged to position sense throughout the range of motion of said tonneau cover and to output instantaneous information on the angular position of the tonneau cover, and

said control means is arranged to receive the angular position information outputted by both said first and second position sensors, to determine therefrom the instantaneous position of said convertible top and said tonneau cover and to actuate said motive means in response thereto.

[0008] According to a third aspect of the present invention there is provided a method of retracting and extending an automotive convertible top using a system of the first or second aspect of the present invention, the method including;

sensing a command issued by an automobile user to retract or extend the convertible top;

initiating movement of said convertible top in accordance with said sensed command, and

monitoring the instantaneous position of said convertible top as it moves to ensure said convertible top is moving properly.

[0009] One advantage of the present invention is that the structural elements can be moved simultaneously to achieve a more fluid sequence of movements and to decrease the amount of time it takes to extend and retract the convertible top.

[0010] Another advantage is that, because the instantaneous positions of the various structural elements are being monitored, the system and method are capable of instituting remedial action in the event that the structural elements become misaligned during the sequence of movements. A further important feature of the presently preferred embodiment is that the monitoring of the convertible top's structural elements is accomplished through the use of only a few sensors, thereby simplifying the assembly of the system and reducing the cost associated therewith. Another feature of the presently preferred embodiment is that the system and method are capable of diagnosing failures within the system, and generating failure indications, whereby the automobile owner or a qualified service person can interpret the error information and perform the necessary repairs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Other objects, features and advantages of the present invention will become more apparent after understanding the following description of the presently preferred embodiment in conjunction with the drawings in which:

FIGURES 1 through 8 are diagrams illustrating the movement of the elements of the convertible top as it is retracted and extended;
FIGURE 9 is a functional diagram detailing the relationship between the motor, sensor, structural element and controller at one particular pivot point in the convertible top mechanism; and
FIGURES 10 and 11 are flow charts depicting the control methodology employed to ensure proper sequencing of the various structural elements as the convertible top is retracted and extended.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT

[0012] As illustrated in FIGURES 1 through 8, the present invention is directed toward a mechanism which can automatically raise and lower an automobile convertible top. As can be appreciated by those of ordinary skill in the art, while each different type of automobile requires a different convertible top suited to the particular vehicle, the concepts disclosed herein are equally applicable to a wide variety of configurations. In the presently preferred embodiment, the vehicle 10 has a convertible top 12 which is stored in a compartment beneath a tonneau cover 14, and a rear quarter window 16. Generally, the tonneau cover 14 must be raised, and the rear quarter windows 16 must be lowered before the convertible top 12 is lowered or raised. This insures that the top 12 will be properly stored in the compartment beneath the tonneau cover 14 and also insures that the rear quarter windows 16 are clear of the top 12 as it moves, thereby preventing damage.

[0013] More particularly, the lowering, or retracting, of the convertible top occurs in the following manner. First,

as shown in FIGURE 1, the top 12 is unlatched from the header 22. In this embodiment, screw motors unhook J-hooks latched to the header 22 such as disclosed in assignee's issued U. S. Patent No. 5,058,939. However, it will be appreciated that other forms of latches could be used. Additionally, the latches could be manual, with conventional sensors to indicate whether the person operating the car has yet unlatched the latches. Once the latches are unlatched, the rest of the movements necessary to lower the top 12 can commence.

[0014] The next movement in the sequence, shown in FIGURE 2, is the raising of the #5 bow 24 so the tonneau cover 14 can be raised, and the lowering of the forward side windows 20 and rear quarter windows 16. The forward side windows 20 are lowered and the rear quarter windows 16 are lowered to allow the top to move freely without worry of damaging the windows 16, 20. Once the #5 bow 24 reaches a position clear of the sweep path of the tonneau cover 14, the tonneau cover begins raising, shown in FIGURE 3. Next, once the tonneau cover 14 reaches a position clear of the sweep path of the #5 bow 24, the #5 bow lowers, as shown in FIGURE 4, and the main portion 26 of the convertible top 12 begins lowering into the compartment 28 beneath the tonneau cover 14, as shown in FIGURES 5-7. Finally, once the top is fully retracted into the compartment 28, as shown in FIGURE 7, the tonneau cover 14 is lowered to cover the compartment 28, as shown in FIGURE 8. To raise, or extend, the convertible top 12, the sequence of movements are simply reversed. The linkages per se and the motors used can be of conventional design, such as disclosed in U. S. Patents 3,180,675 and 3,312,058.

[0015] In order to provide the unique control of this invention of the various elements, such as the latches, #5 bow 24, tonneau cover 14 and main portion 26, a unique arrangement of sensors is provided. As illustrated in FIGURE 9, each sensor in the preferred embodiment takes the form of a rotary variable resistance device or potentiometer 30 mounted at the pivot point of a pair of elements or links (to sense the relative position of one link with respect to the other) or a pivot point between a link and the vehicle's chassis (to sense the relative position of the link with respect to the chassis. It will be appreciated that sensors are provided at each critical pivot point in the mechanism, and applicants have discovered that only three sensors are required to achieve full control of the top. The three points of relative movement requiring sensing are the position of the #5 bow 24 with respect to the main portion 26, the position of the main portion 26 with respect to the vehicle chassis, or body, and the position of the tonneau cover 14 with respect to the vehicle body. The position sensors are mounted at these three critical pivot point 31, 32 and 33. For example, as detailed in FIGURE 9, the sensor provided at the pivot point 31 of the #5 bow 24 is shown diagramatically in greater detail. Here it can be seen how the potentiometer 30 measures the relative position between the #5 bow 24 and the main portion 26. The pivot point sensors are electrically connected to the controller 34 which monitors the positional information provided by the sensors (i.e. voltage or amperage) and, in response to these signals, commands the movement of the convertible top 12. In this embodiment, cantilevered DC motors move the various elements, although it should be appreciated that other motive means could be utilized, such as, for example, hydraulic pumps. In order to move the tonneau cover 14, #5 bow 24 and main portion or top linkage 26, the movement of the DC motors is governed by the controller 34. As illustrated, the #5 bow motor 36 raises and lowers the #5 bow 24, and the #5 bow potentiometer 30 measures the relative angular position of the #5 bow 24 with respect to the main portion 26. In response to the detected position of the #5 bow, as well as the positions of the other elements, the controller 34 issues commands to the #5 bow motor 36 to raise or lower the #5 bow 24 as needed. The other motors are similarly controlled.

[0016] The interaction of the controller 34, DC motors and sensors can be better understood by referencing theflow charts of FIGURES 10 and 11. The controller 34 is powered by the vehicle's electrical system, and includes driver circuits for providing current to the motors, A/D converters for sensing the stall condition of the motors and for receiving the instantaneous positional information provided by the potentiometers and command input lines for receiving and interpreting the "top up" or "top down" signals issued by the automobile driver through the up/down switches 38, all of which are interfaced to a microprocessor. It can be appreciated by those of ordinary skill in the art that the electronics and circuitry comprising the controller 34 can take a variety of forms, however the microprocessor, converters and drivers selected for this embodiment provide a convenient means by which to execute the invention.

[0017] In this embodiment, the controller 34 monitors the linkage element positional information provided by the sensors to determine the instantaneous position of the linakge elements. The controller 34 also monitors for a stall condition at the motors to determine if a motor is being unduly loaded, such as would occur if the linkage being driven by the motor were jammed. Within the logic circuitry of the microprocessor of the controller 34 are instructions for interpretting the monitored information and for directing current to the motors to drive the motors in accordance with the action desired by the automobile driver.

[0018] In this embodiment, the driver is provided with "up" and "down" buttons located on the dashboard. These directional control buttons 38 are electrically linked to the controller 34 and determine which sequence of movements of the convertible top 12 are desired. As shown in FIGURE 10, the general control system logic progresses in the following manner. If the driver presses the "up" button and the top 12 is already fully raised, no action is taken, as indicated by function block

50 and action nmenomic 52. Similarly, if the "down" button is pressed while the top 12 is fully lowered, no action is taken 60, 62. However, the normal course of events would be that the "down" button is pressed when the top 12 is up, and the "up" button pressed when the top 12 is down.

[0019] It should be noted that, in this embodiment, the driver must continue to depress the "down" button for the top 12 to continue moving down, and must continue pressing the "up" button for the top to continue moving up. When the top is up and the "down" button is pressed, the controller 34 senses the directional command desired by the automobile driver and begins initiating the sequence of movements necessary to lower the top 12. First, the J-hooks are unlatched, the windows lowered and the #5 bow 24 is raised until the positional sensors indicate that the #5 bow is in the up position and the tonneau cover is in the down position. Provided the "down" button is still being depressed, the next action is to raise the tonneau cover. The positional information provided by the sensors should then be that the #5 bow, main and tonneau cover are in the up position. Now that the tonneau cover is clear, the #5 bow is lowered, leaving the main and tonneau cover up. Next, the main is lowered, leaving only the tonneau cover in the up position. Finally, the tonneau cover is lowered and the windows raised, completing the lowering of the covertible top 12.

[0020] To raise the convertible top 12, the controller senses the "up" command issued by the automobile driver and begins the sequence of actions necessary for raising the top 12. First, the tonneau cover is raised and windows lowered, leaving the main and #5 bow in the down position but the tonneau cover in the up position. Once the tonneau cover is clear, the main is raised so that both the tonneau cover and main are in the up position. Next, the #5 bow is raised so that all elements are in the up position. Once the #5 bow is clear of the sweep path the tonneau cover is lowered, leaving the main and #5 bow up. Finally, the #5 bow lowered, the J-hooks latched and the windows raised, completing the sequence of motions necessary to raise the top.

[0021] As shown in FIGURE 11, the actual logic process includes initializing the controller upon power-up and resetting the logic control sequence. Next, the controller reads the position sensor and directional command switch information and determines the position of the linkage elements with respect to the directional command desired. Based upon this information the proper movement in the sequence of movements is selected and commanded.

[0022] It can be appreciated from this diagram that while each given motion sequence is executed, the controller returns to the beginning of the control logic sequence and reassesses the positional and direction information in order to determine the next desired motion

[0023] In practice, the control logic progresses as described in conjunction with FIGURE 10, with the additional features of detecting improper linkage postioning and/or excessive motor loading, and selects the motion sequence necessary to remedy the situation. Thus, for example, if the controller 34 is currently commanding the tonneau cover to raise and a stall condition is detected at the motor driving the tonneau cover, the controller stops the motor and reassesses the positional information to determine if the another action is required. Similarly, in the event that the tonneau cover is being raised but the #5 bow slips into the path of the tonneau cover, the positional information will reveal this potentially damaging situation and initiate the raising of the #5 bow to insure the tonneau cover has proper clearance to move. Finally, in the event that an unrecoverable error occurs, the up and down buttons can be depressed simultaneously to reset the system. Upon resetting, qualified service personnel can access the controller 34 and receive error information such as whether one of the sensors has become grounded or shorted or whether one of the motors is experienceing difficulty. Thus, service can be provided more quickly and cheaply because the convertible top system is self-diagnosing.

Claims

1. A system for lowering and raising an automotive convertible top (12) comprising at least two relatively pivotable structural elements (24,26) forming a support structure over which the top (12) is mounted, said system comprising:

   motive means (36) associated with said convertible top (12) for pivoting a first one (26) of said structural elements about a first pivot point (32) and for pivoting a second one (24) of said elements about a second pivot point (31) to move said convertible top (12) to open and close the convertible top (12);
   position sensing means (30) associated with said convertible top (12); and
   control means (34) associated with said position sensing means (30) and said motive means (36);

   characterised in that

   said position sensing means (30) includes a first rotary variable resistance device mounted at said first pivot point (32) and a second rotary variable resistance device mounted at said second pivot point (31), said first rotary variable resistance device being arranged to position sense throughout the range of motion of said first structural element (26) about said first pivot point (32) and to output instantaneous information on the angular position of the first element and said second rotary variable resistance device being arranged to position sense throughout the range of motion of said second

structural element (24) about said second pivot point (31) and to output instantaneous information on the angular position of the second element; and

said control means (34) is arranged to receive the angular position information outputted by both said first and second rotary variable resistance devices, to determine therefrom the instantaneous position of said convertible top and to actuate said motive means (36) in response thereto.

2. The system of claim 1, wherein said convertible top (12) is relatively rigid.

3. The system of claim 1, wherein said convertible top (12) is formed of a relatively flexible material.

4. The system of any preceding claim, wherein the convertible top (12), when fully retracted, is stored beneath a tonneau cover (14) pivotally attached to the automobile.

5. The system of claim 4, wherein said motive means (36) is arranged to move said structural elements (24, 26) and said tonneau cover (14) to retract and extend said convertible top (12).

6. The system of claim 4 or claim 5, wherein said position sensing means (30) is further arranged to indicate the instantaneous position of said tonneau cover (14).

7. The system of claim 6, wherein said control means (34) is arranged to control the movements of said motive means (36) based upon the indicated instantaneous positions of said structural elements (24, 26) and said tonneau cover (14).

8. A system for lowering and raising an automotive convertible top (12), said system comprising:

motive means (36) associated with said convertible top (12) for moving said convertible top (12) to open and close the convertible top (12) and for moving a tonneau cover (14) pivotally attached to the automobile and beneath which the convertible top is arranged to be stored when retracted to its fully open position;
position sensing means (30) associated with said convertible top (12) and with said tonneau cover (14); and
control means (34) associated with said position sensing means (30) and said motive means (36);

characterised in that

said position sensing means (30) includes a first position sensor and a second position sensor, said first position sensor being arranged to position sense throughout the range of motion of a structural element (24, 26) over which the top (12) is mounted and to output instantaneous information on the angular position of that element and said second position sensor being arranged to position sense throughout the range of motion of said tonneau cover (14) and to output instantaneous information on the angular position of the tonneau cover (14), and

said control means (34) is arranged to receive the angular position information outputted by both said first and second position sensors, to determine therefrom the instantaneous position of said convertible top (12) and said tonneau cover (14) and to actuate said motive means (36) in response thereto.

9. The system of claim 8, wherein said convertible top (12) is comprised of a plurality of structural elements (24, 26) forming a support structure over which the top is mounted.

10. The system of claim 9, wherein said convertible top (12) is relatively rigid.

11. The system of claim 9, wherein said convertible top (12) is formed of a relatively flexible material.

12. The system of any of claims 9, 10 and 11, wherein said motive means (36) is arranged to move said structural elements (24, 26) to open and close said convertible top (12).

13. A method of retracting and extending an automotive convertible top (12) using a system as claimed in any one of the preceding claims, the method including;

sensing a command issued by an automobile user to retract or extend the convertible top (12);
initiating movement of said convertible top in accordance with said sensed command, and
monitoring the instantaneous position of said convertible top (12) as it moves to ensure said convertible top (12) is moving properly.

14. A method as claimed in claim 13, further comprising initiating remedial movement of said convertible top (12) in the event that said monitored instantaneous positions indicate said convertible top (12) is not moving properly.

15. The method of claim 14, wherein said remedial action includes;

initiating movement of said convertible top (12) to correct said indicated improper movement; and
ceasing movement of said convertible top (12) if said improper movement cannot be corrected.

16. The method of any one of claims 13 to 15, further including the steps of;

initiating the movement of a or the tonneau cover (14) in conjunction with said initiation of movement of said convertible top (12); and

monitoring the instantaneous positions of both said tonneau cover (14) and said convertible top (12) as they move to ensure said tonneau cover (14) and convertible top (12) are moving properly.

Patentansprüche

1. System zum Herunterlassen und Aufrichten eines Kraftfahrzeug-Faltdachs (12) mit mindestens zwei relativ schwenkbaren Konstruktionselementen (24, 26), die einen Stützaufbau bilden, über dem das Dach (12) montiert ist, wobei das System folgendes umfaßt:

eine zu dem Faltdach (12) gehörige Antriebseinrichtung (36) zum Schwenken eines ersten (26) der Konstruktionselemente um einen ersten Drehpunkt (32) und zum Schwenken eines zweiten (24) der Elemente um einen zweiten Drehpunkt (31), um das Faltdach (12) zum Öffnen und Schließen des Faltdachs (12) zu bewegen;

eine zu dem Faltdach gehörige Lagemeßeinrichtung (30); und

eine zu der Lagemeßeinrichtung (30) und der Antriebseinrichtung (36) gehörige Steuereinrichtung (34);

dadurch gekennzeichnet, daß
die Lagemeßeinrichtung (30) eine an dem ersten Drehpunkt (32) angebrachte erste drehbare Vorrichtung mit veränderlichem Widerstand und eine an dem zweiten Drehpunkt (31) angebrachte zweite drehbare Vorrichtung mit veränderlichem Widerstand umfaßt, wobei die erste drehbare Vorrichtung mit veränderlichem Widerstand dazu ausgelegt ist, über den gesamten Bereich der Bewegung des ersten Konstruktionselements (26) um den ersten Drehpunkt (32) die Position zu erfassen und Informationen über die momentane Winkelstellung des ersten Elements zu liefern, und wobei die zweite drehbare Vorrichtung mit veränderlichem Widerstand dazu ausgelegt ist, über den gesamten Bereich der Bewegung des zweiten Konstruktionselements (24) um den zweiten Drehpunkt (31) die Position zu erfassen und Informationen über die momentane Winkelstellung des zweiten Elements zu liefern; und
die Steuereinrichtung (34) dazu ausgelegt ist, die von der ersten und der zweiten drehbaren Vorrichtung mit veränderlichem Widerstand gelieferten Informationen über die Winkelstellung zu empfangen, um daraus die momentane Position des Faltdachs zu ermitteln und die Antriebseinrichtung (36) in Reaktion darauf zu betätigen.

2. System nach Anspruch 1, bei dem das Faltdach (12) relativ steif ist.

3. System nach Anspruch 1, bei dem das Faltdach (12) aus einem relativ flexiblen Material gebildet ist.

4. System nach einem der vorhergehenden Ansprüche, bei dem das Faltdach (12) dann, wenn es vollständig eingefahren ist, unter einer Verdeckabdekkung (14) gelagert wird, die schwenkbar an dem Kraftfahrzeug angebracht ist.

5. System nach Anspruch 4, bei dem die Antriebseinrichtung (36) dazu ausgelegt ist, die Konstruktionselemente (24, 26) und die Verdeckabdeckung (14) so zu bewegen, daß das Faltdach (12) eingefahren und ausgefahren wird.

6. System nach Anspruch 4 oder Anspruch 5, bei dem die Lagemeßeinrichtung (30) ferner dazu ausgelegt ist, die momentane Position der Verdeckabdeckung (14) anzuzeigen.

7. System nach Anspruch 6, bei dem die Steuereinrichtung (34) dazu ausgelegt ist, die Bewegungen der Antriebseinrichtung (36) anhand der angezeigten momentanen Positionen der Konstruktionselemente (24, 26) und der Verdeckabdeckung (14) zu steuern.

8. System zum Herunterlassen und Aufrichten eines Kraftfahrzeug-Faltdachs (12), wobei das System folgendes umfaßt:

eine zu dem Faltdach (12) gehörige Antriebseinrichtung (36) zum Bewegen des Faltdachs (12), um das Faltdach (12) zu öffnen und zu schließen, und zum Bewegen einer Verdeckabdeckung (14), die schwenkbar an dem Kraftfahrzeug befestigt ist und unter der das Faltdach gelagert werden kann, wenn es in seine vollständig geöffnete Stellung eingefahren wird;

eine zu dem Faltdach (12) und der Verdeckabdeckung (14) gehörige Lagemeßeinrichtung (30); und

eine zu der Lagemeßeinrichtung (30) und der Antriebseinrichtung (36) gehörige Steuereinrichtung (34);

dadurch gekennzeichnet, daß
die Lagemeßeinrichtung (30) einen ersten Positionssensor und einen zweiten Positionssensor umfaßt, wobei der erste Positionssensor dazu ausgelegt ist, über den gesamten Bereich der Bewegung eines Konstruktionselements (24, 26), über dem das Dach (12) montiert ist, die Position zu erfassen und Informationen über die momentane Winkelstellung jenes Elements zu liefern, und wobei der zweite Positionssensor dazu ausgelegt ist, über den gesamten Bereich der Bewegung der Verdeckabdekkung (14) die Position zu erfassen und Informationen über die momentane Winkelstellung der Verdeckabdeckung (14) zu liefern; und
die Steuereinrichtung (34) dazu ausgelegt ist, die von dem ersten und dem zweiten Positionssensor gelieferten Informationen über die Winkelstellung zu empfangen, um daraus die momentane Position des Faltdachs (12) und der Verdeckabdeckung (14) zu ermitteln und in Reaktion darauf die Antriebseinrichtung (36) zu betätigen.

9. System nach Anspruch 8, bei dem das Faltdach (12) aus mehreren Konstruktionselementen (24, 26) besteht, die einen Stützaufbau bilden, über dem das Dach montiert ist.

10. System nach Anspruch 9, bei dem das Faltdach (12) relativ steif ist.

11. System nach Anspruch 9, bei dem das Faltdach (12) aus einem relativ flexiblen Material gebildet ist.

12. System nach einem der Ansprüche 9, 10 und 11, bei dem die Antriebseinrichtung (36) dazu ausgelegt ist, die Konstruktionselemente (24, 26) so zu bewegen, daß das Faltdach (12) geöffnet und geschlossen wird.

13. Verfahren zum Einfahren und Ausfahren eines Kraftfahrzeug-Faltdachs (12) unter Verwendung eines Systems nach einem der vorhergehenden Ansprüche, wobei das Verfahren folgende Schritte umfaßt:

    Erfassen eines Befehls, der von einem Kraftfahrzeugbenutzer ausgegeben wird, um das Faltdach (12) einzufahren oder auszufahren;

    Einleiten einer Bewegung des Faltdachs entsprechend dem erfaßten Befehl; und

    Überwachen der momentanen Stellung des Faltdachs (12), während es sich bewegt, um sicherzustellen, daß sich das Faltdach (12) korrekt bewegt.

14. Verfahren nach Anspruch 13, bei dem ferner eine Hilfsbewegung des Faltdachs (12) eingeleitet wird, wenn die überwachten momentanen Positionen anzeigen, daß sich das Faltdach (12) nicht korrekt bewegt.

15. Verfahren nach Anspruch 14, bei dem der Hilfsvorgang folgendes umfaßt:

    Einleiten einer Bewegung des Faltdachs (12), um die angezeigte inkorrekte Bewegung zu korrigieren; und

    Beenden der Bewegung des Faltdachs (12), wenn die inkorrekte Bewegung nicht korrigiert werden kann.

16. Verfahren nach einem der Ansprüche 13 bis 15, wobei das Verfahren ferner die folgenden Schritte umfaßt:

    Einleiten der Bewegung einer bzw. der Verdeckabdeckung (14) in Verbindung mit dem Einleiten der Bewegung des Faltdachs (12); und

    Überwachen der momentanen Positionen sowohl der Verdeckabdeckung (14) als auch des Faltdachs (12), während sich diese bewegen, um sicherzustellen, daß sich die Verdeckabdeckung (14) und das Faltdach (12) korrekt bewegen.

Revendications

1. Système pour abaisser et relever un toit pliant d'automobile (12) comprenant au moins deux éléments porteurs (24 ,26) articulés l'un par rapport à l'autre, formant une structure porteuse sur laquelle le toit (12) repose, ledit système comprenant :

    - des moyens moteurs (36) associés audit toit pliant (12) pour faire tourner un premier élément (26) desdits éléments porteurs autour d'un premier point de pivot (32) et pour faire tourner un second élément (24) desdits éléments porteurs autour d'un second point de pivot (31) pour déplacer ledit toit pliant (12) en vue d'ouvrir et de fermer le toit pliant (12) ;
    - des moyens de détection de position (30) associés audit toit pliant (12) ;et
    - des moyens de commande (34) associés audits moyens de détection de position (30) et audits moyens moteurs (36) ;

    caractérisé en ce que :

    - lesdits moyens de détection de position (30)

comprennent une première résistance variable par rotation montée audit premier point de pivot (32) et une seconde résistance variable par rotation montée audit second point de pivot (31), ladite première résistance variable par rotation étant adaptée pour détecter une position comprise dans la plage de mouvement dudit premier élément porteur (26) autour dudit premier point de pivot (32) et pour sortir une information instantanée sur la position angulaire du premier élément et ladite seconde résistance variable par rotation étant adaptée pour détecter une position comprise dans la plage de mouvement dudit second élément porteur (24) autour dudit second point de pivot (31) et pour sortir une information instantanée sur la position angulaire du second élément ; et

- lesdits moyens de commande (34) sont agencés pour recevoir les informations de sortie sur la position angulaire des deux dites première et seconde résistances variables par rotation, pour en déterminer la position instantanée dudit toit pliant et pour actionner en réponse lesdits moyens moteurs (36).

2. Système selon la revendication 1, **caractérisé en ce que** ledit toit pliant (12) est relativement rigide.

3. Système selon la revendication 1, **caractérisé en ce que** ledit toit pliant (12) est formé d'un matériau relativement flexible.

4. Système selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le toit pliant (12), entièrement remplié, est rangé sous un capot (14) en liaison pivot avec l'automobile.

5. Système selon la revendication 4, **caractérisé en ce que** lesdits moyens moteurs (36) sont agencés pour déplacer lesdits éléments porteurs (24, 26) et ledit capot (14) afin d'ouvrir et de fermer ledit toit pliant (12).

6. Système selon l'une quelconque des revendications 4 ou 5, **caractérisé en ce que** les moyens de détection de position (30) sont également adaptés pour indiquer la position instantanée dudit capot (14).

7. Système selon la revendication 6, **caractérisé en ce que** lesdits moyens de commande (34) sont adaptés pour commander les mouvements desdits moyens moteurs (36) en fonction des positions instantanées indiquées desdits éléments porteurs (24, 26) et dudit capot (14).

8. Système pour abaisser et relever un toit pliant d'automobile (12), ledit système comprenant :

- des moyens moteurs (36) associés audit toit pliant (12) pour déplacer ledit toit pliant (12) en vue d'ouvrir et de fermer le toit pliant (12) et pour déplacer le capot (14) en liaison pivot avec l'automobile et sous lequel le toit pliant est adapté pour être rangé lorsqu'il est replié depuis sa position entièrement ouverte ;
- des moyens de détection de position (30) associés audit toit pliant (12) et audit capot (14) ; et
- des moyens de commande (34) associés audits moyens de détection de position (30) et audits moyens moteurs (36) ;

caractérisé en ce que :

- lesdits moyens de détection de position (30) comprennent un premier capteur de position et un second capteur de position, ledit premier capteur de position étant adapté pour détecter une position comprise dans la plage de déplacement de l'un des éléments porteurs (24, 26) sur lesquels le toit (12) est monté et pour sortir une information instantanée sur la position angulaire de cet élément et ledit second capteur de position étant adapté pour détecter une position comprise dans la plage de mouvement dudit capot (14) et pour sortir une information instantanée sur la position angulaire du capot (14), et
- lesdits moyens de commande (34) sont adaptés pour recevoir les informations de sortie sur la position angulaire des deux dits premier et second capteurs, pour en déterminer la position instantanée dudit toit pliant (12) et pour actionner en réponse lesdits moyens moteurs (36).

9. Système selon la revendication 8, **caractérisé en ce que** ledit toit pliant (12) comprend une pluralité d'éléments porteurs (24, 26) formant une structure porteuse sur laquelle le toit est monté.

10. Système selon la revendication 9, **caractérisé en ce que** ledit toit pliant (12) est relativement rigide.

11. Système selon la revendication 9, **caractérisé en ce que** ledit toit pliant (12) est formé d'un matériau relativement flexible.

12. Système selon l'une quelconque des revendications 9, 10 et 11, **caractérisé en ce que** lesdits moyens moteurs (36) sont adaptés pour déplacer lesdits éléments porteurs (24, 26)en vue d'ouvrir ou de fermer ledit toit pliant (12).

13. Procédé pour abaisser et relever un toit pliant d'automobile (12) tel que revendiqué dans l'une

quelconque des revendications précédentes, le procédé comprenant :

- la détection d'une commande, donnée par un automobiliste , de replier ou de déplier le toit pliant (12) ;
- le lancement du mouvement dudit toit pliant en fonction de ladite commande détectée, et
- la surveillance de la position instantanée dudit toit pliant (12) à mesure qu'il se déplace pour garantir que ledit toit pliant (12) se déplace correctement.

14. Procédé selon la revendication 13, comprenant également le lancement d'un mouvement de correction dudit toit pliant (12) si lesdites positions instantanées relevés par le dispositif de surveillance indiquent que le toit pliant (12) ne se déplace pas correctement.

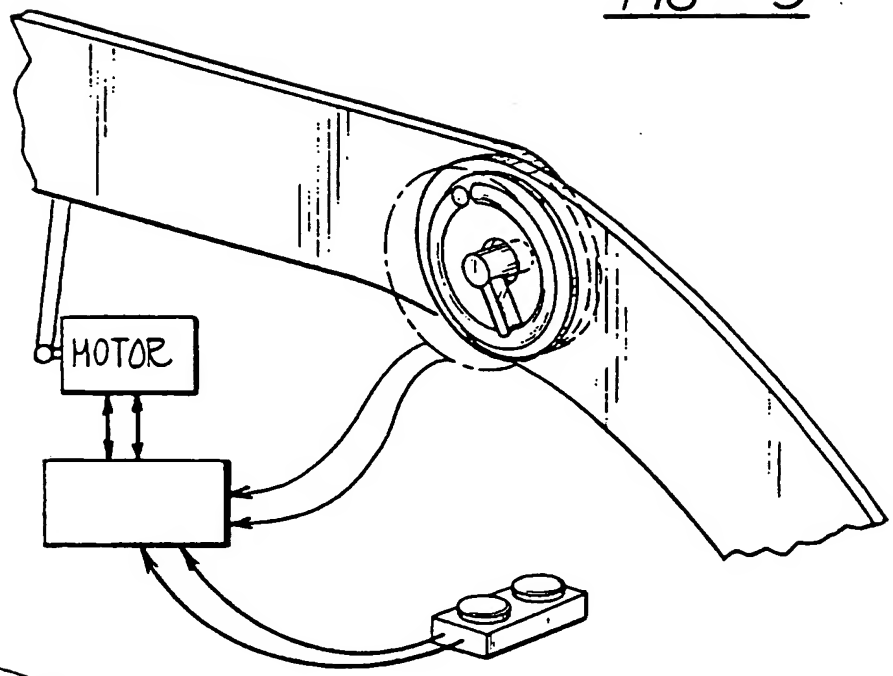
15. Procédé selon la revendication 14, **caractérisé en ce que** ladite action de correction comprend :

- le lancement du mouvement dudit toit pliant (12) pour corriger ledit mouvement incorrect détecté ; et
- l'arrêt du mouvement dudit toit pliant (12) si ledit mouvement incorrect ne peut être corrigé.

16. Procédé selon l'une quelconque des revendications 13 à 15, comprenant également les étapes consistant à :

- lancer le mouvement d'un ou du capot (14) conjointement audit lancement du mouvement dudit toit pliant (12) ; et
- surveiller les positions instantanées dudit capot (14) et dudit toit pliant (12) à mesure qu'ils se déplacent, pour garantir que ledit capot (14) et ledit toit pliant (12) se déplacent correctement.

FIG - 9



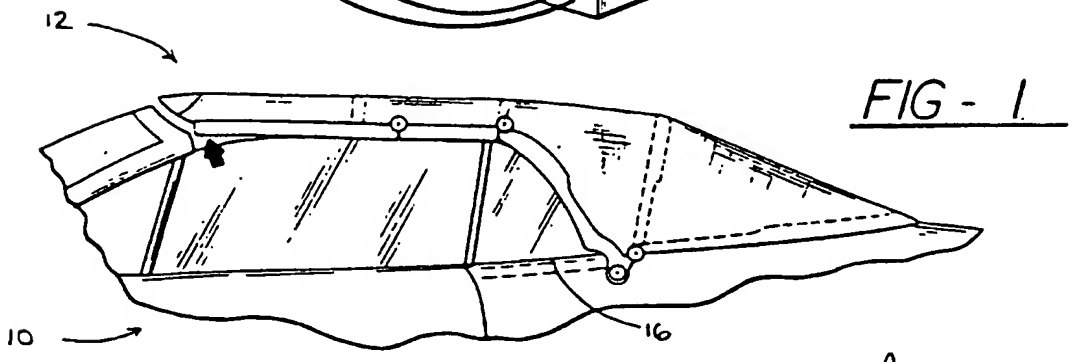


FIG - 1

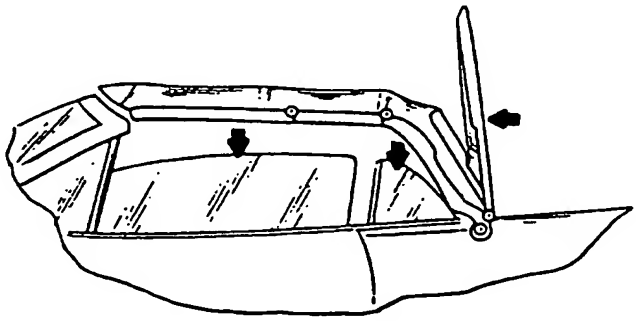


FIG - 2

FIG - 3

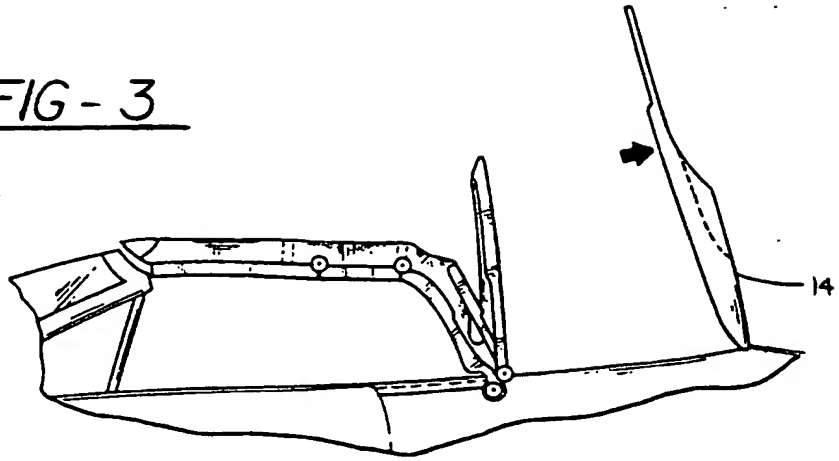


FIG - 4

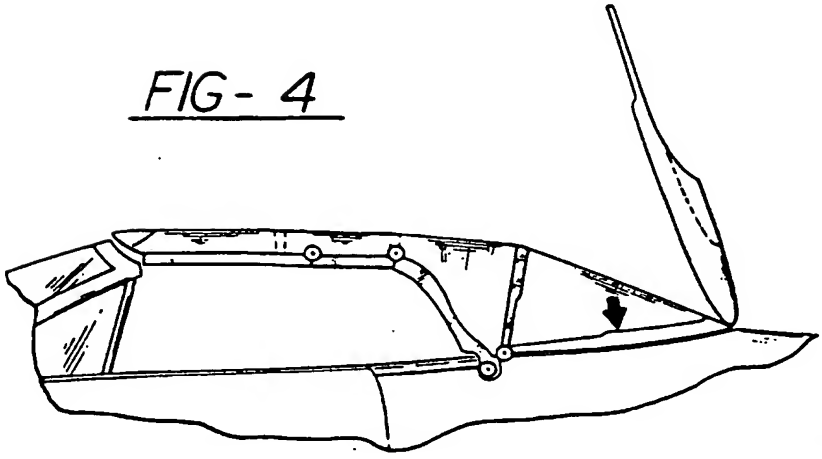


FIG - 5

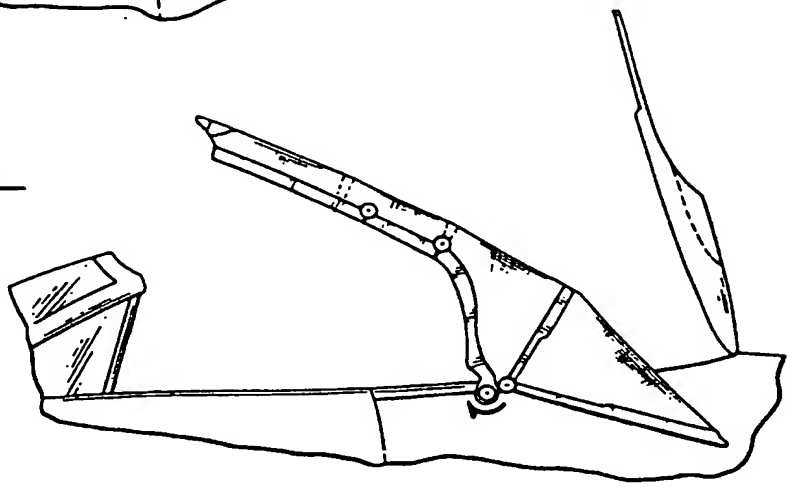


FIG - 6

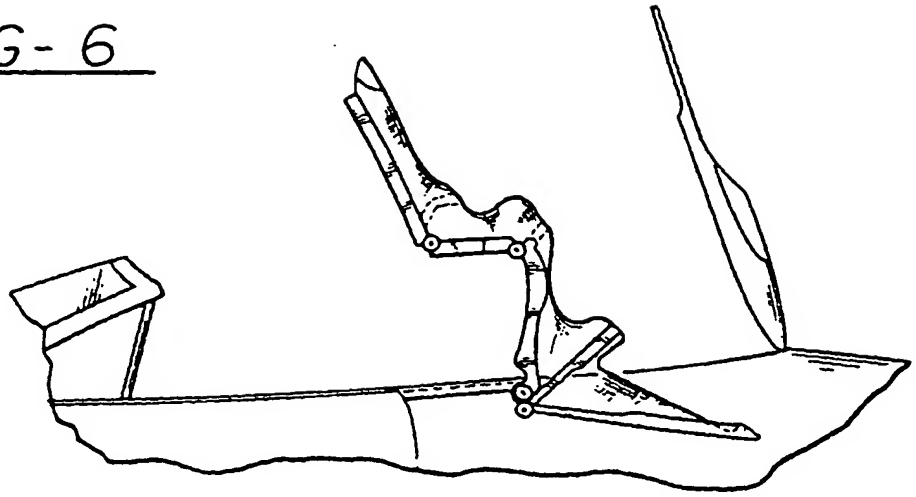


FIG - 7

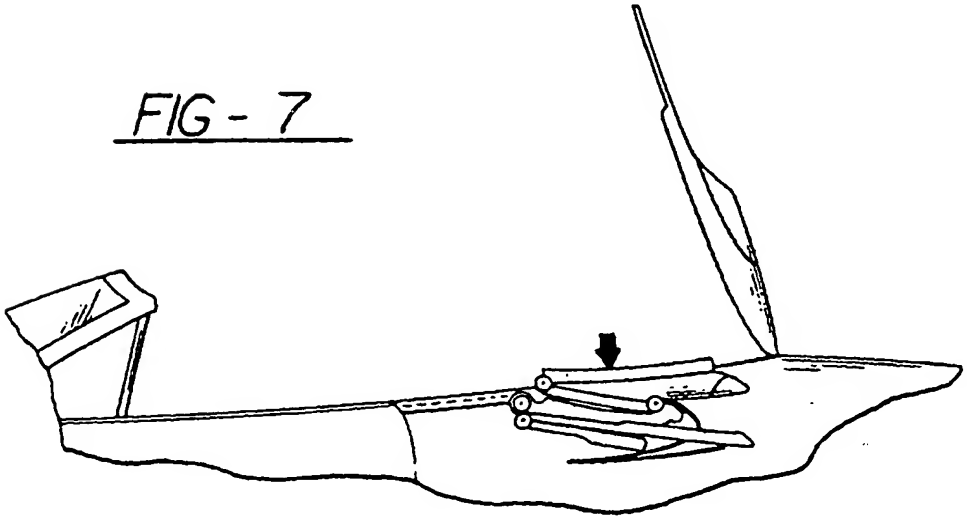
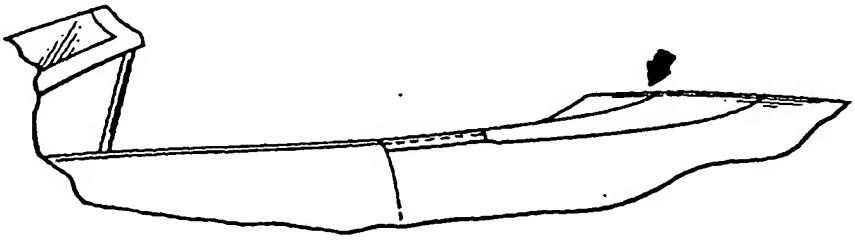


FIG - 8



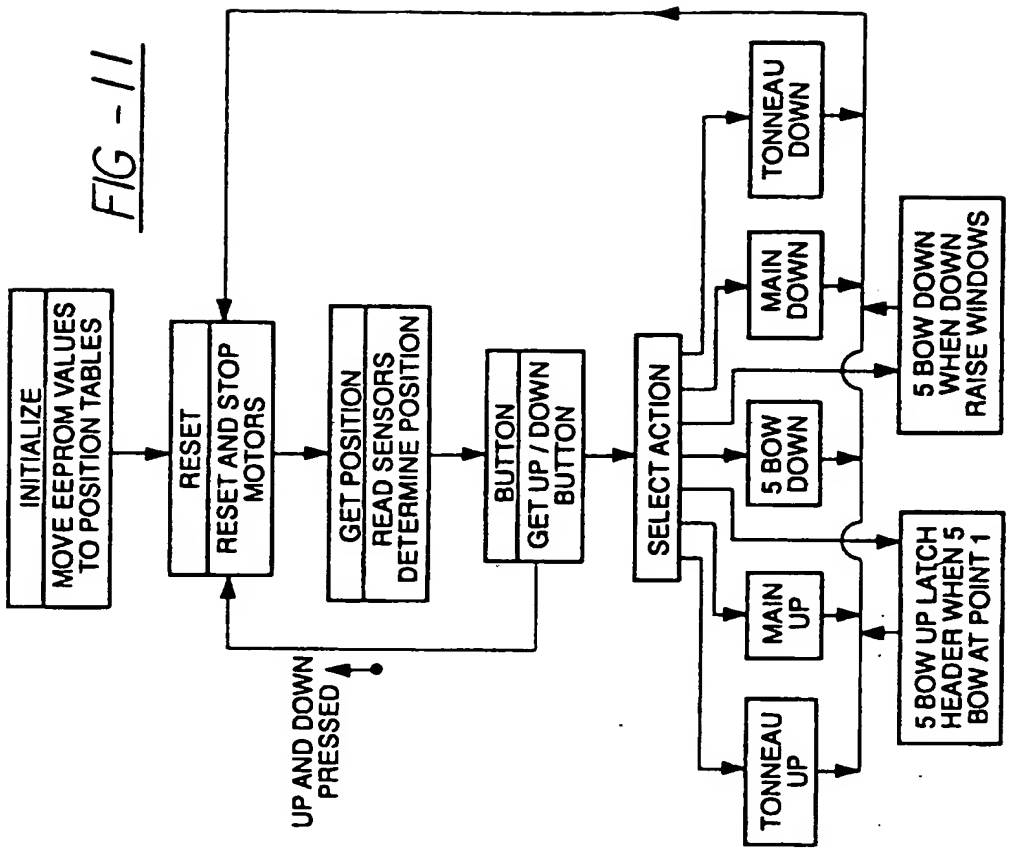

INITIALIZE
MOVE EEPROM VALUES TO POSITION TABLES
RESET
RESET AND STOP MOTORS
GET POSITION
READ SENSORS DETERMINE POSITION
BUTTON
GET UP / DOWN BUTTON
SELECT ACTION
TONNEAU UP
MAIN UP
5 BOW DOWN
MAIN DOWN
TONNEAU DOWN
5 BOW UP LATCH HEADER WHEN 5 BOW AT POINT 1
5 BOW DOWN WHEN DOWN RAISE WINDOWS
UP AND DOWN PRESSED

FIG - 11

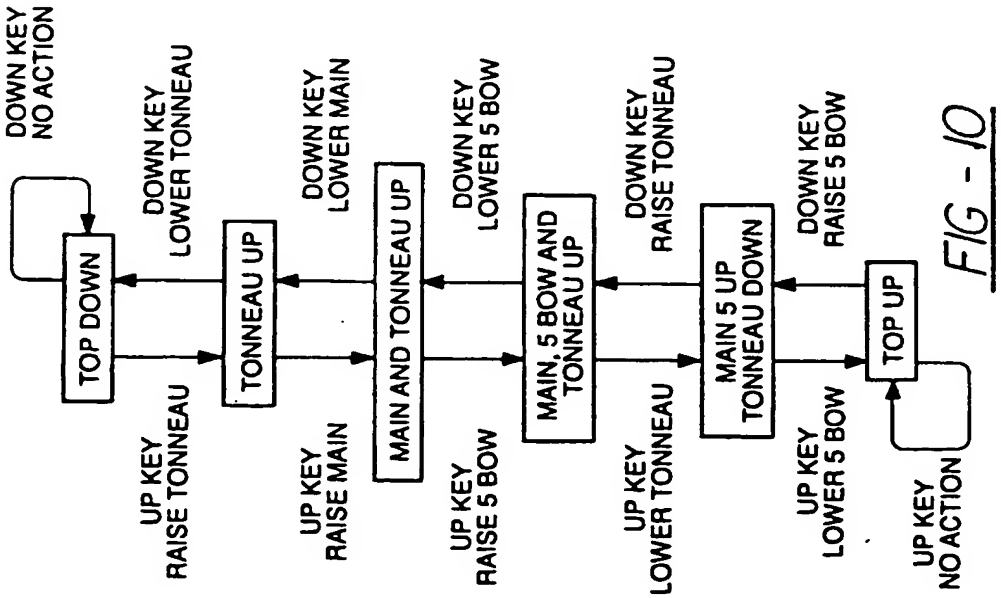

TOP DOWN
DOWN KEY NO ACTION
UP KEY NO ACTION
TONNEAU UP
DOWN KEY LOWER TONNEAU
UP KEY RAISE TONNEAU
MAIN AND TONNEAU UP
DOWN KEY LOWER MAIN
UP KEY RAISE MAIN
MAIN, 5 BOW AND TONNEAU UP
DOWN KEY LOWER 5 BOW
UP KEY RAISE 5 BOW
MAIN 5 UP TONNEAU DOWN
DOWN KEY RAISE TONNEAU
UP KEY LOWER TONNEAU
TOP UP
DOWN KEY RAISE 5 BOW
UP KEY LOWER 5 BOW

FIG - 10